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09/671,538	09/27/2000	Jyoti Mazumder	POM-11902/29	6711

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EXAMINER	
RAPP, CHAD	

ART UNIT	PAPER NUMBER
2125	

DATE MAILED: 12/23/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/671,538	MAZUMDER ET AL.	
	Examiner	Art Unit	
	Chad Rapp	2125	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 September 2000*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *5*.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

1. Claims 1-20 are presented for examination.

Specification

2. The abstract of the disclosure is objected to because it contains too many words(must be less than or equal to 150 words). Correction is required. See MPEP § 608.01(b).

3. The disclosure is objected to because of the following informalities:

The section titled "Reference to related applications" needs to be updated because some of the applications have become patents.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1-2 and 5-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Coronel et al. in view of McCay et al.

Coronel et al. teaches the claimed invention (claim1) substantially as claimed including a method of optimizing a laser –assisted direct metal deposition process wherein material added to a melt pool is solidified to fabricate an object according to a description thereof comprising:

a. Creating a database including acceptable direct metal deposition process parameters based upon previously obtained empirical data is taught as a database that contains

process parameters in normal operating conditions and it contains the history of the wafer(abstract);

b. Referring to the deposition of the object to determine if the object is being fabricated in accordance with the description and if so is taught as pre and post processing measurement to determine if the wafer is still within specifications at each output of chamber(col. 2 lines 39-49);

c. Referring to the database to determine if the process parameters are within acceptable limits and if not is taught as analysis rules are developed to perform a comparison and associated rejection criteria are coded in the form of algorithms which are stored in a database(col. 1 lines 10-20);

d. Implementing a corrective action is taught as an adequate action is immediately taken(col. 1 lines 10-20).

Coronel et al. teaches the above listed details of the independent claim 1, however, Coronel et al. does not teach: measuring one or more dimensions of the melt pool and monitoring the accumulation of residual stress of the object.

McCay et al. teaches :

a. Monitoring the accumulation of residual stress of the object is taught as an acoustic work piece which detects the work piece internal stress waves(col. 1 lines 28-30);

b. Measuring one or more dimensions of the melt pool is taught as video imaging of the laser/surface interaction region(col. 13 line 11-13).

It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of McCay et al. because both

patents contain the monitoring of process parameters to be used as feedback to keep the system running within acceptable limits. Coronel et al. speaks of some of the key parameters such as gas flows, pressure, temperature and RF powers. McCay et al. brings in additional key parameters, stress and melt pool dimensions. The more key process parameters that are measured the more the system can improve the design and bring the design into tight tolerances.

As to claim 2, McCay et al. teaches wherein the process parameter is the accumulation of stress within the object is taught as an acoustic work piece which detects the work piece internal stress waves(col. 1 lines 28-30).

It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of McCay et al. because both patents contain the monitoring of process parameters to be used as feedback to keep the system running within acceptable limits. Coronel et al. speaks of some of the key parameters such as gas flows, pressure, temperature and RF powers. McCay et al. brings in additional key parameters, stress dimensions. The more key process parameters that are measured the more the system can improve the design and bring the design into tight tolerances.

As to claim 5, McCay et al. teaches wherein the corrective measure is to modify the speed of the deposition is taught as the controller communicates with the movement system for purposes of regulating relative movement between the delivery system and the work piece such as rate of speed and direction(col. 8 lines 23-27).

It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of McCay et al. because another parameter that needs to be measure and kept in normal limits is the rate of the deposition

speed. Things that affect this measure are the movement of the delivery system which has the application unit connected. The controller regulates the delivery system with the application unit to speed up or slow down do to the feedback signals.

As to claim 6, McCay et al. teaches wherein the residual stress of the object is monitored through sub-harmonic vibration is taught as an acoustic work piece which detects the work piece internal stress waves(col. 1 lines 28-30).

It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of McCay et al. It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of McCay et al. because both patents contain the monitoring of process parameters to be used as feedback to keep the system running within acceptable limits. Coronel et al. speaks of some of the key parameters such as gas flows, pressure, temperature and RF powers. McCay et al. brings in additional key parameters, stress dimensions. The more key process parameters that are measured the more the system can improve the design and bring the design into tight tolerances.

As to claim 7, McCay et al. teaches wherein the process parameter is the temperature of the melt pool is taught as temperature measurements can be used to provide feedback fro purposes of modifying the operating parameters of the laser. The process can use pyrometric temperature measurement of the surface of the work piece near the laser/surface interaction region(col. 12 line 65 to col. 13 line 19).

It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of McCay et al. It would have

been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of McCay et al. because both patents contain the monitoring of process parameters to be used as feedback to keep the system running within acceptable limits. Coronel et al. speaks of some of the key parameters such as gas flows, pressure, temperature and RF powers. McCay et al. brings in the monitoring and feedback of the key parameters temperature. This feed back and motoring of the temperature makes the design have tight tolerances.

As to claim 8,McCay et al. teaches wherein the corrective measure is to modify the power delivered to the laser is taught as temperature measurements can be used to provide feedback for purposes of modifying the operating parameters of the laser; primarily the power of the laser beam(col. 12 line 65 to col. 13 line 19).

It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of McCay et al. because the feedback of the monitored temperature allows the controller of the system to change the power of the laser to keep the design operating at normal conditions.

6. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Coronel et al. in view of McCay et al. and further in view of Lewis et al.

Coronel et al. teaches the claimed invention (claim1) see paragraph number 5 above.

As to claim 3, Lewis et al. teaches wherein the corrective measure is modify the contour path of the laser is taught as tool path adjustments can be made to affect heat flow(col. 23 lines 44-45).

It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of Lewis et al. because the patents deal with control signals to adjust the apparatus functions. One apparatus adjustment is a tool path adjustment affecting the temperature parameter of heat flow; allowing the adjustment of the path of the laser brings the heat flow back in to normal condition parameters.

7. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Coronel et al. in view of McCay et al. and further in view of Jeantette et al.

Coronel et al. teaches the claimed invention (claim1) see paragraph number 5 above.

As to claim 4, Jeantette et al. teaches wherein the corrective measure is to modify the mass flow of the powder is taught as the powder flow sensor measures the flow of powdered material to the delivery system and produce either a relative mass-flow signal or a calibrated mass-flow signal for a particular powered material. The sensor also provides a means of measuring pulsations or variations in the flow pattern and provides a method to indicate if unstable operating conditions are present.

It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of Jeantette et al. because both patents comprise a feedback loop control. When low frequency variations in the powder stream are detected t signal is provided to the mass powder flow control. The various sensor can be also used individually to provide an error signal to make the process more robust.

8. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Coronel et al. in view of McCay et al. and further in view of Duley et al.

Coronel et al. teaches the claimed invention (claim1) see paragraph number 5 above.

As to claim 9, Duley et al. teaches wherein one or more dimensions of the melt pool are measured by monitoring the light received at the pixels of an optical detector is taught as a visible light detector to detect light from a laser material interaction zone. It determines the number of bright pixels above a pre-defined number which effectively gives the spatial exterior area of the visible light emitted from an interaction zone(abstract).

It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of Duley et al. because both patents deal with controlling process variables in a laser processing system. One the process parameters measured by the Duley et al. invention is the dimensions of a melt pool. The Duley et al. invention brings in the ability to monitor the variables in real time.

9. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Coronel et al. in view of McCay et al. and further in view of Watkins.

Coronel et al. teaches the claimed invention (claim1) see paragraph number 5 above.

As to claim 10, Watkins teaches wherein the database includes look-up table is taught as a database lookup table(col. 7 lines 11-17).

It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of Watkins because the Watkins

patent describes process control and it establishes baseline values through a plurality or runs and analysis.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claims 11-12 and 15-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Coronel et al. in view of McCay et al.

Coronel et al. teaches the claimed invention (claim 11) substantially as claimed including a system for optimizing a laser-assisted direct metal deposition process wherein an object fabricated in accordance with a description thereof the system comprising;

a. A database including acceptable direct metal deposition process parameters based upon previously obtained empirical data is taught as is taught as a database that contains process parameters in normal operating conditions and it contains the history of the wafer(abstract);

b. Refer to the description of the object to determine if the object is being fabricated in accordance with the description and if so is taught as pre and post processing measurement to determine if the wafer is still within specifications at each output of chamber(col. 2 lines 39-49);

c. Refer to the database to determine if the process parameters are within acceptable limits if not is taught as analysis rules are developed to perform a comparison and associated rejection criteria are coded in the form of algorithms which are stored in a database(col. 1 lines 10-20);

d. Implement a corrective action is taught as an adequate action is immediately taken(col. 1 lines 10-20).

Coronel et al. teaches the above listed details of the independent claim 1, however, Coronel et al. does not teach: a controllably movable deposition head including a laser operative to form a melt pool on the surface of the object and a supply of powder feeding the melt pool to be solidified as the deposition head is traversed, a first sensor for detecting one or more dimensions of the melt pool, a second sensor the sensing the accumulation of residual stress of the object and a controller interfaced to the laser, deposition head movement control, database and first and second sensors, the controller being operative to perform the following functions McCay et al. teaches:

a. A controllably movable deposition head including a laser operative to form a melt pool on the surface of the object and a supply of powder feeding the melt pool to be solidified as the deposition head is traversed is taught as laser, interaction zone(melt pool), application unit(deliveries powder to work piece) and the delivery system moves the application unit(col. 7 line 34, col. 7 lines 65-37 and col. 13 line 10);

b. A first sensor for detecting one or more dimensions of the melt pool is taught as video imaging of the laser/surface interaction region(col. 13 line 11-13);

c. A second sensor the sensing the accumulation of residual stress of the object is taught as an acoustic work piece which detects the work piece internal stress waves(col. 1 lines 28-30);

d. A controller interfaced to the laser, deposition head movement control, database and first and second sensors, the controller being operative to perform the following functions is taunt as a laser, application unit connected to the delivery system, the first (video imaging)and second sensor(acoustic signals) signals are sent (feedback information) to the controller(col. 7 line 34, col. 7 lines 65-37 and col. 12 line 65 to col. 13 line 44).

It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of McCay et al. because both patents contain the monitoring of process parameters to be used as feedback to keep the system running within acceptable limits. Coronel et al. speaks of some of the key parameters such as gas flows, pressure, temperature and RF powers. McCay et al. brings in additional key parameters, stress and melt pool dimensions. The more key process parameters that are measured the more the system can improve the design and bring the design into tight tolerances.

As to claim 12, McCay et al. teaches wherein the process parameter is the accumulation of stress within the object is taught as an acoustic work piece which detects the work piece internal stress waves(col. 1 lines 28-30).

It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of McCay et al. because both patents contain the monitoring of process parameters to be used as feedback to keep the system running within acceptable limits. Coronel et al. speaks of some of the key parameters such as

gas flows, pressure, temperature and RF powers. McCay et al. brings in additional key parameters, stress dimensions. The more key process parameters that are measured the more the system can improve the design and bring the design into tight tolerances.

As to claim 15, McCay et al. teaches wherein the corrective measure is to modify the speed of the deposition is taught as the controller communicates with the movement system for purposes of regulating relative movement between the delivery system and the work piece such as rate of speed and direction(col. 8 lines 23-27).

It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of McCay et al. because another parameter that needs to be measure and kept in normal limits is the rate of the deposition speed. Things that affect this measure are the movement of the delivery system which has the application unit connected. The controller regulates the delivery system with the application unit to speed up or slow down do to the feedback signals.

As to claim 16, McCay et al. teaches wherein the residual stress of the object is monitored through sub-harmonic vibration is taught as an acoustic work piece which detects the work piece internal stress waves(col. 1 lines 28-30).

It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of McCay et al. It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of McCay et al. because both patents contain the monitoring of process parameters to be used as feedback to keep the system running within acceptable limits. Coronel et al. speaks of some of the key parameters such as gas flows,

pressure, temperature and RF powers. McCay et al. brings in additional key parameters, stress dimensions. The more key process parameters that are measured the more the system can improve the design and bring the design into tight tolerances.

As to claim 17, McCay et al. teaches wherein temperature sensors taught as pyrometric temperature(col. 12 line 65 to col. 13 line 19).

It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of McCay et al. It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of McCay et al. because both patents contain the monitoring of process parameters to be used as feedback to keep the system running within acceptable limits. Coronel et al. speaks of some of the key parameters such as gas flows, pressure, temperature and RF powers. McCay et al. brings in the monitoring and feedback of the key parameters temperature. This feed back and motoring of the temperature makes the design have tight tolerances.

As to claim 18,McCay et al. teaches wherein the corrective measure is to modify the power delivered to the laser is taught as temperature measurements can be used to provide feedback for purposes of modifying the operating parameters of the laser; primarily the power of the laser beam(col. 12 line 65 to col. 13 line 19).

It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of McCay et al. because the feedback of the monitored temperature allows the controller of the system to change the power of the laser to keep the design operating at normal conditions.

12. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Coronel et al. in view of McCay et al. and further in view of Lewis et al.

Coronel et al. teaches the claimed invention (claim11) see paragraph number 12 above

As to claim 13, Lewis et al. teaches wherein the corrective measure is modify the contour path of the laser is taught as tool path adjustments can be made to affect heat flow(col. 23 lines 44-45).

It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of Lewis et al. because the patents deal with control signals to adjust the apparatus functions. One apparatus adjustment is a tool path adjustment affecting the temperature parameter of heat flow; allowing the adjustment of the path of the laser brings the heat flow back in to normal condition parameters.

13. Claims 14 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Coronel et al. in view of McCay et al. and further in view of Jeantette et al.

Coronel et al. teaches the claimed invention (claim 11) see paragraph number 12 above.

As to claim 14, Jeantette et al. teaches wherein the corrective measure is to modify the mass flow of the powder is taught as the powder flow sensor measures the flow of powdered material to the delivery system and produce either a relative mass-flow signal or a calibrated mass-flow signal for a particular powered material. The sensor also provides a means of measuring pulsations or variations in the flow pattern and provides a method to indicate if unstable operating conditions are present.

It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of Jeantette et al. because both patents comprise a feedback loop control. When low frequency variations in the powder stream are detected t signal is provided to the mass powder flow control. The various sensor can be also used individually to provide an error signal to make the process more robust.

As to claim 20, Jeantette et al. teaches that including multiple deposition heads is taught as four jets(col. 7 line 23).

It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of Jeantette et al. because the multiple heads allows functionally graded or dissimilar composition structures to be fabricated directly from CAD solid model; which makes the system versatile.

14. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Coronel et al. in view of McCay et al. and further in view of Duley et al.

Coronel et al. teaches the claimed invention (claim11) see paragraph number 12 above.

As to claim 19, Duley et al. teaches wherein the second sensor is a one or two-dimensional pixelized image sensor is taught as a visible light detector to detect light from a laser material interaction zone. It determines the number of bright pixels above a pre-defined number which effectively gives the spatial exterior area of the visible light emitted from an interaction zone(abstract).

It would have been obvious to one of ordinary skill at the time the invention was made or used to modify the teachings of Coronel et al. with the teachings of Duley et al. because both

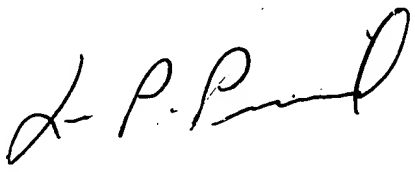
patents deal with controlling process variables in a laser processing system. One the process parameters measured by the Duley et al. invention is the dimensions of a melt pool. The Duley et al. invention brings in the ability to monitor the variables in real time.

Conclusion

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chad Rapp whose telephone number is (703)306-4528. The examiner can normally be reached on Mon-Fri 11:00-7:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo Picard can be reached on (703)308-0538. The fax phone number for the organization where this application or proceeding is assigned is (703)746-7239.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)305-9600.



Chad Rapp
Examiner
Art Unit 2125

cjr

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